

the four principal OP compounds used on almonds was estimated by correlating: 1) residues on hawks with spray application timing relative to capture of birds and 2) correlations with serum cholinesterase depression. The probable routes of exposure to the birds include dermal absorption through feet and ingestion of residues from prey and during preening. This work was supported by the Almond Board of California.

#### TELEMETRY VIA SATELLITES FOR RAPTOR STUDIES

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Monitoring animal movements by satellite was first accomplished in 1970 with an elk in Wyoming. The large size of early transmitter packages restricted their use to very large animals. Miniaturization of electronic components in the 1980s allowed application of satellite telemetry to large birds. Satellite transmitters have been tested with mixed results on geese, swans, petrels, bustards, eagles, and falcons. Dramatic weight reduction in the 1980s was quickly followed by tests of a variety of transmitter shapes on captive birds. Research on attachment methods helped in selecting those methods least likely to elicit adverse behavior. Wind tunnel experiments were conducted to produce more aerodynamically efficient PTT designs. Recently, the utility of satellite tracking has been demonstrated in studies of wandering albatrosses in the Indian Ocean, migrating Bewick's swans, bald eagles, and golden eagles. Two other studies demonstrated the feasibility of tracking cranes by satellite. The types of information from these techniques will be presented and cross-referenced to a poster display and demonstration.

#### HABITAT SELECTION BY MEXICAN SPOTTED OWLS IN NORTHERN ARIZONA

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Although the Spotted Owl (*Strix occidentalis*) has been the object of considerable attention in the Pacific Northwest, little is known about the habitat requirements of the Mexican Spotted Owl (*S. o. lucida*). We compared use of broad habitat types to availability of those types within the home ranges of eight radio-tagged Mexican Spotted Owls in northern Arizona. When all habitat types were considered, no owls used these types in proportion to availability. Use patterns differed among individuals and by activity type. All owls roosted primarily in virgin mixed-conifer forests. Owls generally foraged more than expected in virgin mixed-conifer and ponderosa pine (*Pinus ponderosa*) forests and less than expected in managed forests. Mature forests ap-

pear to be important to Spotted Owls in this region and different forest types may be used for different activities. Consequently, managers should retain virgin stands of both mixed-conifer and ponderosa pine forest where these owls occur, to provide both roosting and foraging habitat.

#### OBSERVATIONS AND FOOD HABITS OF NESTING GREAT BLACK-HAWKS IN TIKAL NATIONAL PARK, GUATEMALA

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Two active nests of the Great Black-Hawk (*Buteogallus urubitinga ridgwayi* Gurney) were located during the dry season in Tikal National Park, Guatemala. Nests were 20.5 m and 22 m high in mahogany (*Swietenia macrophylla*) and pucte (*Bucida bucerus*) trees, respectively. Each nest contained a single young. Direct nest observations yielded 106 prey items delivered to young; of these, lizards comprised 31%, snakes 28%, birds 13%, anurans and bats 8% each, rodents 6%, and an opossum 1%. Niche breadth (1/D) was 4.51. In terms of biomass, snakes represented 46% of the prey. Incubation time was approximately 40 days. Fledging occurred 65–70 days after hatching in the one successful nest.

#### THE FOOD HABITS, HOME RANGE AND BREEDING OF TWO SYMPATRIC *CICCABA* OWLS

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Thirteen Mottled Owl (*Ciccaba virgata*) nests were studied in Tikal National Park, Petén, Guatemala. Mean clutch size was 2.15. Nine of these nests fledged a total of 16 young and young left the nest at between 27 and 33 days of age. Mean home range size was 20.8 ha (85% harmonic mean) for six radio-tagged breeding males and the density of this population was 7.5 breeding adults per km<sup>2</sup>. Mottled Owls were found to be highly territorial, sedentary, and monogamous. Four nests of the Black-and-white Owl (*C. nigrolineata*) are also described. All were in epiphytes in large, live trees. Mean nest height was 20.5 m. Each nest contained one egg. The home range size of a single radio-tagged male was 437.3 ha (85% harmonic mean). One pair studied during three consecutive years was found to be monogamous and completely sedentary. Both species